

## VERIFICATION OF TRANSLATION

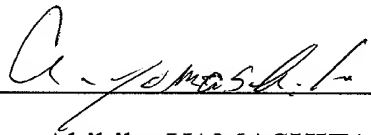
I, Akihiko YAMASHITA of 3rd Floor, Oak Building Kyobashi, 16-10, Kyobashi 1-chome, Chuou-ku, Tokyo, 104-0031 Japan, declare as follows:

1. That I am well acquainted with both English and Japanese languages,  
and

2. That the attached document is a true and correct translation made by  
me to the best of my knowledge and belief of:

The specification accompanying the Application No. 09-214845 for a  
Patent made in Japan filed on August 8, 1997.

April 16, 2008

  
Akihiko YAMASHITA

(No witness required)

[Document Title] APPLICATION FOR PATENT

[Docket Number] DN977231Y

[Filing Date] August 8, 1997

[To] The Commissioner of the Patent Office

Mr. Hisamitsu ARAI

[International Patent Classification] G03C 1/00

[Title of the Invention] PATTERN-FORMING MATERIAL AND METHOD  
FOR PATTERN FORMATION

[Number of Claims] 6

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[Indication of Fees]

[Prepaid Register Number] 014845

[Amount of Fee] ¥21,000

[List of Attached Documents]

[Material Name]	Specification	1
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[Material Name]	Drawing	1
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[Material Name]	Abstract	1
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[General Power of Attorney Number] 9004649

[Need of Proof] Need

[Document Title] SPECIFICATION

[Title of the Invention] PATTERN-FORMING MATERIAL AND METHOD  
FOR PATTERN FORMATION

[Patent claims]

[Claim 1] A pattern-forming material adapted for optically forming a pattern, characterized by comprising a photocatalyst-containing layer provided on a substrate, the photocatalyst-containing layer containing a material of which the wettability is variable through photocatalytic action upon pattern-wise exposure.

[Claim 2] A pattern-forming material adapted for optically forming a pattern, characterized by comprising: a substrate; a photocatalyst-containing layer provided on the substrate, and, provided on the photocatalyst-containing layer, a layer containing a material of which the wettability is variable through photocatalytic action upon pattern-wise exposure.

[Claim 3] A pattern-forming material adapted for optically forming a pattern, characterized by comprising a composition layer, the composition layer comprising a photocatalyst, a material of which wettability is varied through photocatalytic action upon pattern-wise exposure, and a binder.

[Claim 4] The pattern-forming material according to any one of claims 1 to 3, characterized in that the pattern-forming material is an original plate for a printing plate.

[Claim 5] The pattern-forming material according to any one of claims 1 to 4, characterized in that the photocatalyst-containing layer contains a siloxane compound.

[Claim 6] A method for pattern formation adapted for optically forming a pattern, characterized by exposing pattern-wise a pattern-forming material, which comprises a photocatalyst-containing layer provided on a substrate, to vary the wettability of the surface of the pattern-forming material through photocatalytic action.

[Detailed description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a novel pattern-forming material which can be used for printing and other purposes.

[0002]

[Prior Art]

In plates for lithography, i.e., a kind of printing method, printing ink-receptive lipophilic areas and printing ink-unreceptive areas are provided on a flat plate. In use, an ink image to be printed is formed on the lipophilic areas and then transferred and printed onto paper or the like.

[0003]

A large number of proposals have been made on original plates for printing plates that are used in offset printing which

is representative lithography. Among them, plate for offset printing wherein the original plate for a printing plate is directly exposed by electrophotography to prepare a printing plate is widely used. The original plate for an electrophotographic offset printing plate is prepared by a method which comprises the steps of: providing a photoconductive layer composed mainly of supporting body to form a photoreceptor; exposing the photoreceptor by electrophotography to form a highly lipophilic image on the surface of the photoreceptor; and subsequently treating the photoreceptor with a desensitizing liquid to hydrophilify nonimage areas to prepare an original plate for offset printing. Hydrophilic areas are immersed in water or the like and are consequently lipophobified, and a printing ink is received by the lipophilic image areas followed by transfer onto paper or the like.

An original plate for waterless lithography has also been used wherein, instead of the immersion in water to form lipophobic areas, highly lipophobic areas are formed without relying upon immersion in water or the like to form ink-receptive areas and ink-unreceptive areas.

[0004]

Further, a method for producing an original plate for lithography using a heat mode recording material has been proposed which can realize the formation of highly ink-receptive

areas and ink-repellent areas by laser beam irradiation.

Heat mode recording materials can eliminate the need to provide the step of development and the like, and advantageously enables printing plates to be produced simply by forming an image using a laser beam. They, however, suffer from problems associated with the regulation of laser beam intensity, the disposal of residues of solid materials denatured by the laser, the plate wear and the like.

[0005]

[Problems to be solved by the Invention]

It is an object of the present invention to provide a novel pattern-forming material. It is another object of the present invention to obtain a pattern-forming material which can provide a novel original plate for a printing plate that can solve the problems of the conventional original plates for printing plates.

[0006]

[Means for solving the problem]

The present invention provides a pattern-forming material adapted for optically forming a pattern, characterized by comprising a photocatalyst-containing layer provided on a substrate, the photocatalyst-containing layer containing a material of which the wettability is variable through photocatalytic action upon pattern-wise exposure.

The present invention further provides a pattern-forming



material adapted for optically forming a pattern, characterized by comprising: a substrate; a photocatalyst-containing layer provided on the substrate, and, provided on the photocatalyst-containing layer, a layer containing a material of which the wettability is variable through photocatalytic action upon pattern-wise exposure.

The present invention also provides a pattern-forming material adapted for optically forming a pattern, characterized by comprising a composition layer, the composition layer comprising a photocatalyst, a material of which wettability is varied through photocatalytic action upon pattern-wise exposure, and a binder.

Further, the pattern-forming material mentioned above is characterized in that the pattern-forming material is an original plate for a printing plate.

Still further, the pattern-forming material is characterized in that the photocatalyst-containing layer contains a siloxane compound.

The present invention further provides a method for pattern formation adapted for optically forming a pattern, characterized by exposing pattern-wise a pattern-forming material, which comprises a photocatalyst-containing layer provided on a substrate, to vary the wettability of the surface of the pattern-forming material through photocatalytic action.

[0007]

[Preferred embodiment of the Invention]

The present invention relates to a pattern-forming material wherein a pattern is formed by utilizing the action of a photocatalyst that, upon light irradiation, creates a chemical change of materials present around it and thereby forming a pattern in the light-irradiated area. According to the present invention, the pattern, when used in printing of designs, images, letters and the like, refers to areas that, upon transfer of the printing ink, receive or repel the ink.

[0008]

The mechanism of action of the photocatalyst typified by titanium oxide according to the present invention has not been fully elucidated yet. However, it is considered that carriers produced by light irradiation influence the chemical structure of the organic material through a direct reaction with a neighboring compound, or otherwise by active oxygen species produced in the presence of oxygen and water.

[0009]

Proposals utilizing the photocatalytic action include one wherein oil stains are decomposed by light irradiation to hydrophilify the oil stains, enabling the oil stains to be washed away by water, one wherein a hydrophilic film is formed on the surface of glass or the like to impart antifogging properties,

and one wherein a photocatalyst-containing layer is formed on the surface of tiles or the like to form the so-called antimicrobial tiles or the like that can reduce the number of bacteria floating in air.

[0010]

Enhancement in receptivity of pattern areas to printing inks, toners or the like, by utilizing a photocatalytic action such as decomposition of the organic material to vary the wettability of pattern-formed area and the pattern-unformed substrate area has realized the pattern-forming material according to the present invention.

[0011]

Photocatalysts usable in the pattern-forming material according to the present invention include metal oxides known as photoconductors, such as titanium oxide ( $\text{TiO}_2$ ), zinc oxide ( $\text{ZnO}$ ), tin oxide ( $\text{SnO}_2$ ), strontium titanium oxide ( $\text{SrTiO}_3$ ), tungsten oxide ( $\text{WO}_3$ ), bismuth oxide ( $\text{Bi}_2\text{O}_3$ ), and iron oxide ( $\text{Fe}_2\text{O}_3$ ). Among them, titanium oxide is particularly preferred because it has high band gap energy and is chemically stable, nontoxic, and easily available.

[0012]

Titanium oxide may be in anatase form or rutile form with anatase form of titanium oxide being preferred.

Preferably, the anatase form of titanium has the average particle diameter not more than 20 nm. Examples of anatase form of titanium oxide usable herein include ammonia peptization type titania sols (A-6, average crystal diameter 8 nm, manufactured by TAKI CHEMICAL CO., LTD.; STS-11, average crystal diameter 17 nm, manufactured by Ishihara Sangyo Kaisha Ltd.) and nitric acid peptization type titania sols (TA-15, average crystal diameter 12 nm, manufactured by Nissan Chemical Industries Ltd.).

[0013]

The photocatalyst-containing layer according to the present invention may be formed by dispersing a photocatalyst in a binder. The photocatalyst has a fear of decomposing the binder as well upon photoexcitation. Therefore, the binder preferably has a component high has high binding energy as a main component thereof. Further, when use of the pattern-forming material as printing plates is taken into consideration, plate wear and abrasion resistance are also required of the photocatalyst-containing layer.

[0014]

A silicone resin having high binding energy which can express strong strength by cross-linking through a reaction such as sol-gel reaction is preferable.

[0015]

The silicone resin may be a hydrolysis condensate or a

cohydrolysis condensate of at least one member selected from silicon compounds represented by general formula  $Y_nSiX_{4-n}$  wherein  $n$  is 1 to 3;  $Y$  represents an alkyl, fluoroalkyl, vinyl, amino, or epoxy group; and  $X$  represents a halogen or a methoxyl, ethoxyl, or acetyl group.

[0016]

Specific examples thereof include methyltrichlorosilane, methyltribromosilane, methyltrimethoxysilane, methyltriethoxysilane, methyltriisopropoxysilane, methyl-tri-t-butoxysilane; ethyltrichlorosilane, ethyltribromosilane, ethyltrimethoxysilane, ethyltriethoxysilane, ethylsopropoxysilane, ethyl-tri-t-butoxysilane; n-propyltrichlorosilane, n-propyltribromosilane, n-propyltrimethoxysilane, n-propyltriethoxysilane, n-propyltriisopropoxysilane, n-propyl-tri-t-butoxysilane; n-hexyltrichlorosilane, n-hexyltribromosilane, n-hexyltrimethoxysilane, n-hexyltriethoxysilane, n-hexyltriisopropoxysilane, n-hexyl-tri-t-butoxysilane; n-decyltrichlorosilane, n-decyltribromosilane, n-decyltrimethoxysilane, n-decyltriethoxysilane, n-decyltriisopropoxysilane, n-decyl-tri-t-butoxysilane; n-octadecyltrichlorosilane, n-octadecyltribromosilane, n-octadecyltrimethoxysilane, n-octadecyltriethoxysilane, n-octadecyltriisopropoxysilane,

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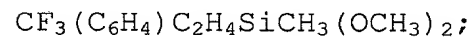
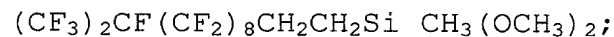
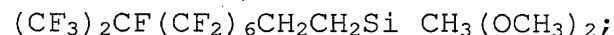
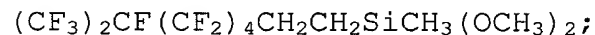
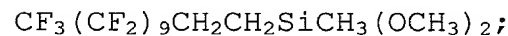
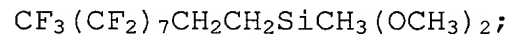
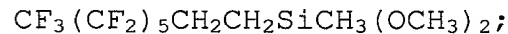
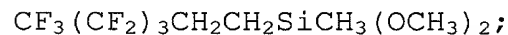
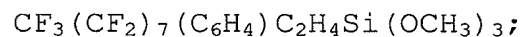
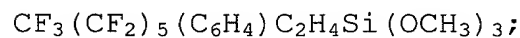
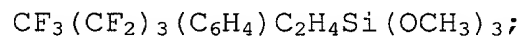
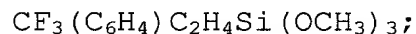
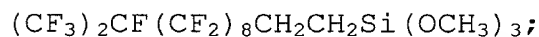
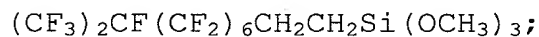
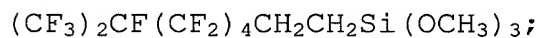
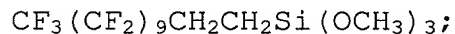
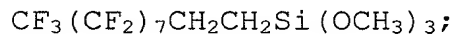
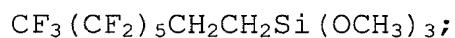
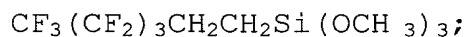
. $\gamma$ -glycidoxypropylmethyl

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 -(3,4epoxycyclohexyl)ethyltrimethoxysilane,  $\beta$   
 -(3,4-epoxycyclohexyl)ethyltriethoxysilane; and partial

hydrolyzates thereof; and mixtures thereof.

[0017]

Further, silane coupling agents containing fluorine which has the following fluoroalkyl chain may be used as these organosiloxane.





$\text{CF}_3(\text{CF}_2)_3(\text{C}_6\text{H}_4)\text{C}_2\text{H}_4\text{SiCH}_3(\text{OCH}_3)_2;$

$\text{CF}_3(\text{CF}_2)_5(\text{C}_6\text{H}_4)\text{C}_2\text{H}_4\text{SiCH}_3(\text{OCH}_3)_2;$

$\text{CF}_3(\text{CF}_2)_7(\text{C}_6\text{H}_4)\text{C}_2\text{H}_4\text{SiCH}_3(\text{OCH}_3)_2;$

$\text{CF}_3(\text{CF}_2)_3\text{CH}_2\text{CH}_2\text{Si}(\text{OCH}_2\text{CH}_3)_3;$

$\text{CF}_3(\text{CF}_2)_5\text{CH}_2\text{CH}_2\text{Si}(\text{OCH}_2\text{CH}_3)_3;$

$\text{CF}_3(\text{CF}_2)_7\text{CH}_2\text{CH}_2\text{Si}(\text{OCH}_2\text{CH}_3)_3;$

$\text{CF}_3(\text{CF}_2)_9\text{CH}_2\text{CH}_2\text{Si}(\text{OCH}_2\text{CH}_3)_3.$

Titanium, aluminum, zirconium, and chromium coupling agents may also be used.

These coupling agents can enhance the cross-linkage and strength.

[0018]

In the layer containing a photocatalyst and one of an organosiloxane, the content of photocatalyst is preferably 5 to 60% by weight, more preferably 20 to 40% by weight. The photocatalyst and the binder may be dispersed in a solvent to prepare a coating liquid followed by coating of the liquid. Solvents usable herein include alcoholic organic solvents, such as ethanol and isopropanol.

[0019]

The excitation wavelength of the anatase form of titania is not more than 380 nm. Therefore, the excitation of this type of photocatalysts should be carried out using ultraviolet light. Ultraviolet light sources usable herein include mercury lamps,

metal halide lamps, xenon lamps, excimer lamps, excimer layer, YAG laser, and other ultraviolet light sources. The wettability of the film surface may be varied by varying the ultraviolet light intensity, exposure and the like.

[0020]

In the photocatalyst-containing composition, an original plate for a printing plate may be formed by homogeneously dispersing an amorphous silica precursor and photocatalyst particles in a nonaqueous solvent, utilizing moisture in air to form a silanol through hydrolysis on a substrate, and conducting dehydropolycondensation at room temperature. When the dehydropolycondensation of the silanol is carried out at 100°C or above, the degree of polymerization is increased, realizing improved strength of the film surface. Further, a layer of photocatalyst can be obtained when an aqueous dispersion such as a photocatalyst aqueous dispersion is used.

[0021]

The photocatalyst-containing coating liquid may be coated onto the substrate by spray coating, dip coating, roll coating, bead coating or the like. When an ultraviolet curable component is contained as the binder, curing by ultraviolet irradiation results in the formation of a photocatalyst-containing composition layer on the substrate.

[0022]

According to one embodiment of the pattern-forming material in the present invention, as shown in FIG. 1A, a photocatalyst-containing composition layer 41 comprising a photocatalyst 2 and a binder 3 is provided on a substrate 1. As shown in FIG. 1B, in order to record pattern information, exposure 5 of specific pattern is carried out, and alkyl chains of the silicone compound are converted to OH groups through the action of a photocatalyst 2, and hydrophilic areas 6 are formed in the surface having hydrophobic properties according to the exposed pattern, permitting pattern information to be recorded by utilizing a difference in wettability therebetween.

In the pattern-forming material according to a second embodiment of the present invention, as shown in FIG. 2A, a photocatalyst-containing composition layer 42 containing a photocatalyst 2 is formed on a substrate 1, and a wettability-variable material layer 7 being variable through photocatalytic action upon exposure to light upon light exposure is further formed on the photocatalyst-containing composition layer. As shown in FIG. 2B, exposure 5 is carried out in a pattern 8 to form, areas 9 having specific wettability according to the pattern. Thus, pattern information is recorded.

[0023]

In the case of the second embodiment, a photocatalyst-containing composition layer, having hydrophilic

properties, of a hydrolyzate or a partial hydrolyzate of a composition comprising a photocatalyst dispersed in tetraalkylsiloxane or the like is formed, and a thin film of an organic material having hydrophobic properties is then formed. The photocatalyst-containing composition layer may be formed by the photocatalyst per se. The thin film of an organic material may be used by solution coating, surface grafting, surfactant treatment, or gaseous phase film formation such as PVD or CVD.

[0024]

Organic materials usable herein include monomeric compounds, polymeric compounds, and surfactants, the wettability of these materials being variable by the photocatalyst. Specific examples of organic materials usable herein include hydrocarbon nonionic surfactants, such as NIKKOL BL, BC, BO, and BB series manufactured by Nihon Surfactant Kogyo K.K.; and fluoro or silicone nonionic surfactants, such as ZONYL FSN and FSO, manufactured by E.I. du Pont de Nemours & Co., Surfluo S-141 and 145 manufactured by Asahi Glass Co., Ltd., Megafac F-141 and 144 manufactured by Dainippon Ink and Chemicals, Inc., Ftergent F-200 and F-251, manufactured by Neos Co., Ltd.; Unidyne DS-401 and 402 manufactured by Daikin Industries, Ltd., and Fluorad FC-170 and 176 manufactured by Sumitomo 3M Ltd. Cationic, anionic, and amphoteric surfactants may also be used.

[0025]

Examples of organic materials other than surfactants usable herein include oligomers and polymers, such as polyvinyl alcohol, unsaturated polyesters, acrylic resins, polyethylene, diallyl phthalate, ethylene propylene diene monomer, epoxy resin, phenolic resin, polyurethane, melamine resin, polycarbonate, polyvinyl chloride, polyamide, polyimide, styrene butadiene rubber, chloroprene rubber, polypropylene, polybutylene, polystyrene, polyvinyl acetate, nylon, polyester, polybutadiene, polybenzimidazole, polyacrylonitrile, epichlorohydrin, polysulfide, and polyisoprene.

[0026]

According to a third embodiment of the present invention, as shown in FIG. 3A, a photocatalyst-containing composition layer 43, containing a photocatalyst 2, a binder 3, and a material 10 which varies its wettability through photocatalytic action upon exposure to light, is formed in a substrate 1. Alternatively, the photocatalyst-containing composition layer 43 may be formed only of a material 10 of which wettability is varied through photocatalytic action upon exposure to light.

The material 10 of which wettability is varied through photocatalytic action upon exposure to light comprises the hydrophobic portion 11 and the hydrophilic portion 12, and thereby the wettability of binder varies to form a layer having an optional wettability.

[0027]

By exposing light of a predetermined pattern, as shown in FIG. 3B, the material 10 of which wettability is varied through photocatalytic action upon exposure to light is dispersed to form areas the surface of which is varied according to the exposed light 5. Pattern information is thus recorded.

Preferred materials capable of varying the wettability include those that can vary the wettability of the photocatalyst-containing composition layer as desired like surfactants.

[0028]

The binder may be an amorphous silica precursor. Those preferred are silicon compounds represented by general formula  $\text{SiX}_{\text{sub}4}$  wherein X represents a halogen, a methoxy, ethoxy, or acetyl group or the like, silanols which are hydrolyzates of the silicon compounds, and polysiloxanes having an average molecular weight of not more than 3000.

[0029]

Specific examples thereof include tetraethoxysilane, tetraisopropoxysilane, tetra-n-propoxysilane, tetrabutoxysilane, and tetramethoxysilane. Further, a hydrolysate of silane coupling agent and a mixture thereof can also be used. As the silane coupling agent, titanium, aluminum, zirconium, and chromium coupling agents may also be used.

[0030]

Surfactants are preferred as the material capable of varying the wettability, and specific examples thereof include hydrocarbon nonionic surfactants, such as NIKKOL BL, BC, BO, and BB series manufactured by Nihon Surfactant Kogyo K.K.; and fluoro or silicone nonionic surfactants, such as ZONYL FSN and FSO, manufactured by E.I. du Pont de Nemours & Co., Surfluon S-141 and 145 manufactured by Asahi Glass Co., Ltd., Megafac F-141 and 144 manufactured by Dainippon Ink and Chemicals, Inc., Ftergent F-200 and F-251, manufactured by Neos Co., Ltd.; Unidyne DS-401 and 402 manufactured by Daikin Industries, Ltd., and Fluorad FC-170 and 176 manufactured by Sumitomo 3M Ltd. Cationic, anionic, and amphoteric surfactants may also be used.

[0031]

Examples of organic materials other than surfactants usable herein include oligomers and polymers, such as polyvinyl alcohol, unsaturated polyesters, acrylic resins, polyethylene, diallyl phthalate, ethylene propylene diene monomer, epoxy resin, phenolic resin, polyurethane, melamine resin, polycarbonate, polyvinyl chloride, polyamide, polyimide, styrene butadiene rubber, chloroprene rubber, polypropylene, polybutylene, polystyrene, polyvinyl acetate, nylon, polyester, polybutadiene, polybenzimidazole, polyacrylonitrile, epichlorohydrin, polysulfide, and polyisoprene.

[0032]

Use of a composition comprising 5 to 60% by weight of the photocatalyst, 95 to 40% by weight of amorphous silica, and 0.1 to 55% by weight of the material of which the wettability is variable through photocatalytic action is preferred.

[0033]

According to the pattern-forming material of the present invention, the surface free energy is varied through the action of the catalyst in the composition, and the wettability-varied areas have varied receptivity to printing ink. Therefore, the pattern-forming material may be used as printing plates. Use of the structure for pattern formation according to the present invention as an original plate for a printing plate can eliminate the need to provide the step of wet development and the like and can offer a feature that the preparation of a printing plate is completed simultaneously with exposure. The pattern formation of the pattern-forming material according to the present invention may be performed by exposure through a process film or the like or by direct pattern formation using a laser or the like.

[0034]

In preparing an original plate for a printing plate, substrates usable herein include those commonly used in offset printing plates, such as aluminum. Alternatively, a pattern



may be formed by coating a photocatalyst-containing composition layer onto a screen of a woven fabric or a nonwoven fabric and exposing the photocatalyst-containing layer. When the substrate is constituted by a material, such as a plastic, that has a fear of being deteriorated by the photo-oxidation activity of the photocatalyst, a silicone, a fluoro resin or the like may be previously coated onto the substrate to form a protective layer. A photochromic material such as spiropyrene may be incorporated into the composition to form a visualized pattern which is formed by the variation caused in wettability. Further, a desired metal pattern may be formed by applying light to the pattern-forming material according to the present invention to form a predetermined pattern of hydrophilic areas, treating the hydrophilic areas with a catalyst for chemical plating and immersing the pretreated material in a chemical plating catalyst to form a desired metal pattern. According to this method, a metal pattern can be formed without the formation of a resist pattern, making it possible to produce printed boards, electronic circuit elements and the like.

[0035]

[EXAMPLES]

The following examples further illustrate the present invention.

Example A-1

Mixer were 30 g of GlascaHPC7002 (Japan Synthetic Rubber Co., Ltd.) and 10 g of Glasca HPC402H (Japan Synthetic Rubber Co., Ltd.), an alkylalkoxysilane. The mixture was stirred for 5 min in a stirring apparatus. The resultant solution was spin coated on a glass substrate having an area of 7.5 cm<sup>2</sup>. The coated substrate was dried at a temperature of 150° for 10 min. Thus, a 2 μm-thick sodium ion block layer was formed.

Next, 15 g of Glasca HPC7002 (Japan Synthetic Rubber Co., Ltd.), 5 g of Glasca HPC402H (Japan Synthetic Rubber Co., Ltd.), and a titania sol (TA-15, manufactured by Nissan Chemical Industries Ltd.) were mixed together. The resultant solution was spin coated onto the substrate with a sodium ion block layer formed thereon. The assembly was dried at a temperature of 150° C for 10 min, permitting hydrolysis and polycondensation to proceed. Thus, a structure for pattern formation comprising a 3 μm-thick photocatalyst-containing layer with a photocatalyst being strongly fixed through an organopolysiloxane was prepared.

[0036]

The structure for pattern formation was irradiated with ultraviolet light at an intensity of 6.6 mW/cm<sup>2</sup> using a xenon lamp. In this case, a change in contact angle between the structure and water with the elapse of time was measured with a contact angle goniometer (Model CA-Z, manufactured by Kyowa Interface Science Co., Ltd.). The results are shown in FIG.

4. As is apparent from the drawing, the contact angle gradually decreased and reached not more than  $10^\circ$ .

Separately, the structure for pattern formation was irradiated with ultraviolet light through a lattice-like mask. Exposure to ultraviolet light at an intensity of  $6.6 \text{ mW/cm}^2$  for 6 hr using a xenon lamp resulted in the formation of a pattern wherein the wettability of exposed areas and the wettability of unexposed areas were different from each other and were  $9^\circ$  and  $102^\circ$ , respectively.

[0037]

#### Example 2

Mixed were 2.7 g of tetraethoxysilane  $\text{Si}(\text{OC}_2\text{H}_5)_4$ , 38.7 g of ethanol, and 4.5 g of 2N Hydrochloric acid, and the mixture was stirred for 10 min. The resultant solution was spin coated on a base material and the coated substrate was dried at a temperature of  $80^\circ \text{C}$  for 30 min. Thus, a  $0.2 \text{ }\mu\text{m}$ -thick sodium ion block layer was formed.

Mixed were 0.62 g of tetraethoxysilane  $\text{Si}(\text{OC}_2\text{H}_5)_4$ , 0.96 g of titania sol (TA-15, manufactured by NISSAN CHEMICAL INDUSTRIES, LTD.), 26.89 g of ethanol, and 0.32 g of pure water, and the mixture was stirred for 10 min. The resultant solution was spin coated on a base material to which the sodium ion layer was formed and the coated substrate was dried at a temperature of  $150^\circ \text{C}$  for 30 min to advance hydrolysis and polycondensation

reaction. Thus, a 0.2  $\mu\text{m}$ -thick photocatalyst-containing composition layer to which a photocatalyst is firmly fixed in silica and which had high surface energy was formed as a sample 1.

Next, a solution of 5 % by weight density wherein an olive oil is dissolved in cyclohexanone was coated onto the photocatalyst-containing composition layer of sample 1 by spin coating so as the coated amount became 1  $\text{g}/\text{m}^2$ . The resultant was dried at 80° C for 10 min. to form an organic material layer having low surface energy as sample 2.

[0038]

sUV exposure was carried out for 5 min. by irradiating a mercury lamp to the samples 1 and 2 at illuminance of 230  $\text{mW}/\text{cm}^2$  and the contact angle with water was measured with a contact angle goniometer (Model CA-Z, manufactured by Kyowa Interface Science Co., Ltd.). The results are shown in Table 1. It was found that the coated organic material layer in sample 2 was decomposed and removed through photocatalytic action so that sample 2 returned to the condition prior to the coating of organic material, i.e., condition of sample 1. It was also found that the wettability of sample 1 wherein a layer having hydrophilic properties formed did not show a substantial change before and after the light irradiation.

[0039]

Table 1

	Before Exposure	After Exposure
SAMPLE 1	8°	7°
SAMPLE 2	47°	7°

## Example 3

A substrate having a sodium ion block layer was prepared in the same manner as in Example 2. Next, 0.14 g of a surfactant (BL-2, manufactured by Nihon Surfactant Kogyo K.K), 0.62 g of tetraethoxysilane  $\text{Si}(\text{OC}_2\text{H}_5)_4$ , 0.96 g of titania sol (TA-15, manufactured by Nissan Chemical Industries Ltd.), 26.89 g of ethanol and 0.32 g of pure water were mixed together. The resultant dispersion was stirred for 10 min. The resultant dispersion was spin coated on the substrate with a sodium block layer of 0.2  $\mu\text{m}$  in thickness formed thereon.

The assembly was dried at a temperature of 150° C for 30 min, permitting hydrolysis and polycondensation to proceed. Thus, a 0.2  $\mu\text{m}$  thick photocatalyst-containing composition layer with a photocatalyst and the surfactant being strongly fixed in silica was formed. A xenon lamp was used to expose UV at illuminance of 3  $\text{m/Wcm}^2$  to the obtained sample and the contact angle of the photocatalyst-containing composition layer with water was measured with a contact angle goniometer (Model CA-Z, manufactured by Kyowa Interface Science Co., Ltd.). The results are shown in FIG. 5. From FIG. 5, it was affirmed that the contact

angle of  $63^\circ$  prior to the exposure was narrowed as the exposure time increased and became  $6^\circ$  in about 80 min. exposure.

[0040]

[Effects of the Invention]

The pattern-forming material of the present invention comprises a photocatalyst-containing composition layer formed on a substrate. Patterns can be formed by wettability of the surface of the photocatalyst-containing composition layer being varied through photocatalytic action upon light exposure. Therefore, the pattern-forming material of the present invention can be used to form patterns without an extra forming process such as a developing process, and thereby it can be used for various applications such as an original plate for a printing plate.

[Brief Description of the Drawing]

[FIG. 1] A diagram showing one embodiment of the present invention.

[FIG. 2] A diagram showing another embodiment of the present invention.

[FIG. 3] A diagram showing yet another embodiment of the present invention.

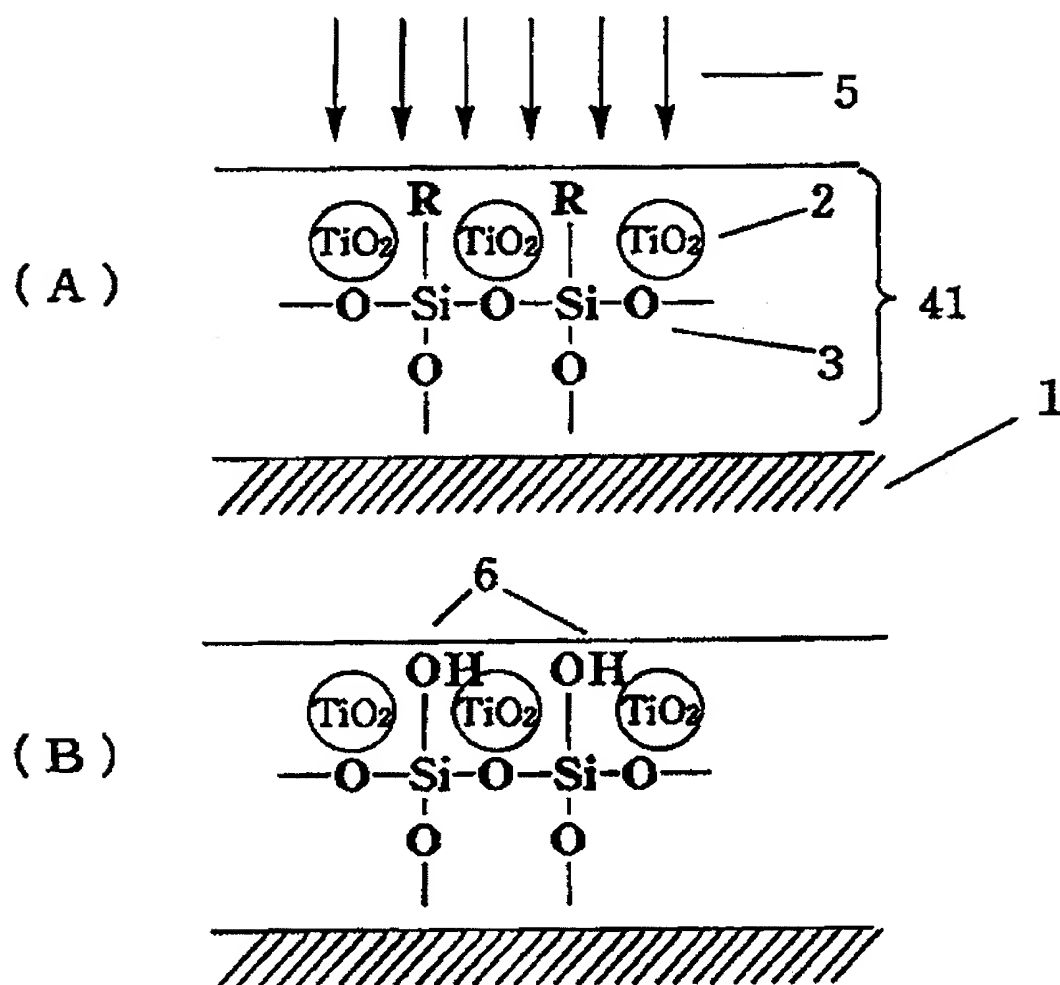
[FIG. 4] A diagram showing the relationship between light irradiation time and wettability of pattern-forming material of the present invention.

[FIG. 5] A diagram showing the relationship between light irradiation time and wettability of pattern-forming material of the present invention.

[Description of the reference number]

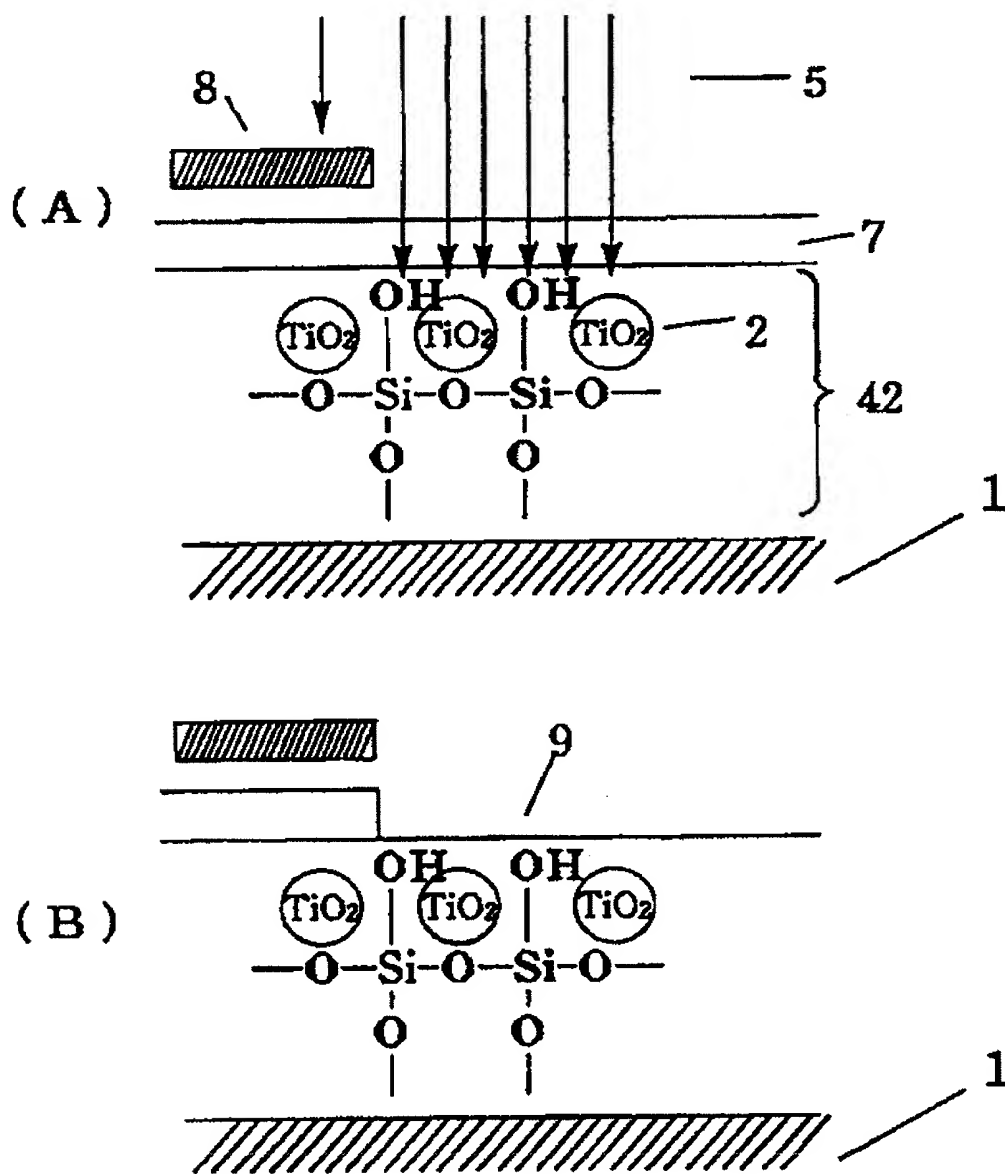
- 1 substrate
- 2 photocatalyst
- 3 binder
- 41, 42, 43 photocatalyst-containing composition layer
- 5 exposure
- 6 hydrophilic area
- 7 wettability-variable material layer
- 8 pattern
- 9 wettability-varied area
- 10 wettability-varying material
- 11 hydrophobic area
- 12 hydrophilic portion

[FIG. 1]

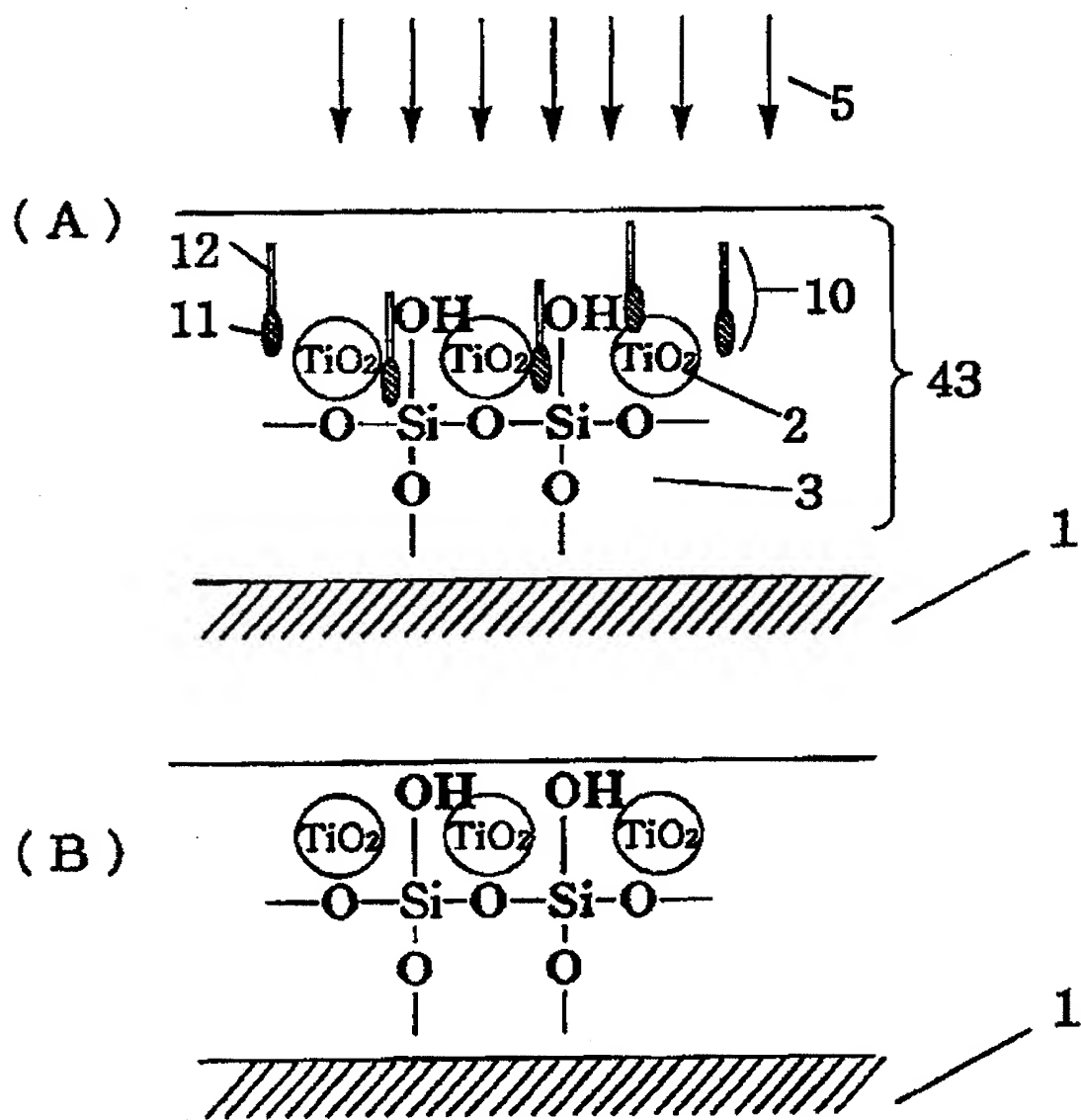




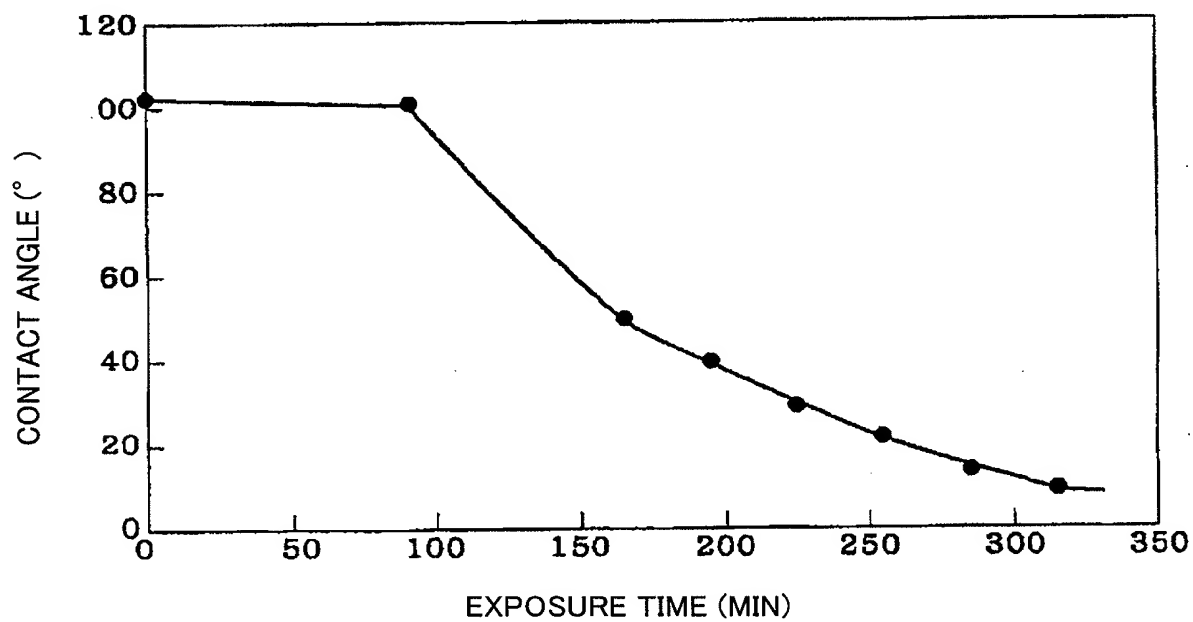
[FIG. 2]



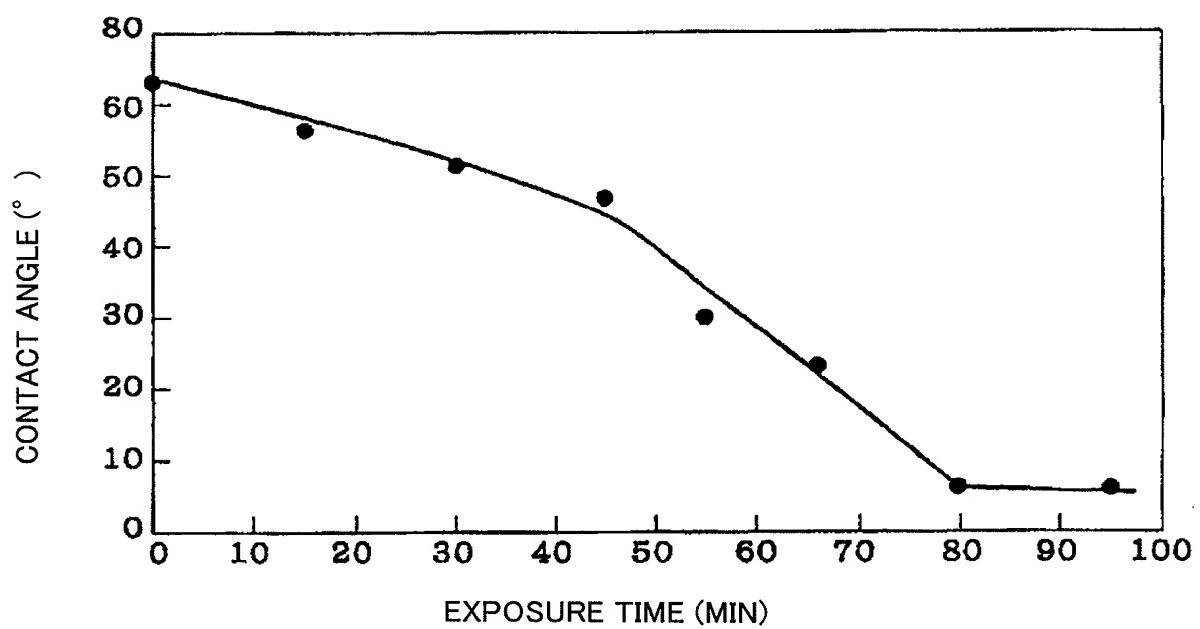
[FIG. 3]



[FIG. 4]



[FIG. 5]



[Document Title]

ABSTRACT

[Abstract]

[Object] A pattern-forming material using a photocatalyst is provided.

[Means of solution] A pattern-forming material comprising a photocatalyst-containing layer provided on a substrate, wherein the photocatalyst-containing layer further comprises a layer containing a material of which wettability is varied through photocatalytic action upon pattern-wise exposure or a layer of a material of which wettability is varied through photocatalytic action upon pattern-wise exposure is provided on the photocatalyst-containing layer, and wherein a pattern is recorded by varying the wettability through exposure.

[Elected Drawing]

FIG. 1